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ABSTRACT

This paper presents a framework for conceptualizing the different ways in which instructions in experimental tasks may be misunderstood. Five possible types of misunderstandings are identified and discussed: (1) misunderstanding of a particular term in the instructions; (2) misinterpretation of a task because the instructions are difficult to interpret within the context of the task; (3) misunderstanding due to instructions which exceed the child's verbal competence; (4) misunderstanding due to problems with ecological validity of the task (i.e., a task unlike anything the child has experienced); and (5) misunderstanding which occurs when processes necessary to solve the problem are also required to decode the instructions. Methods of testing for each type of misunderstanding are presented and discussed. Described is a series of experiments which tested these possible forms of misunderstanding in a task (Bruner and Kenney's fullness of a water jar problem) in which misunderstanding of the experimental instructions had been claimed to account for developmental differences in children's reasoning. Results showed little support for a misunderstanding of instructions hypothesis and instead suggested that the difficulty was in the children's inability to integrate component operations. (JMB)

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The Misunderstanding of Instructions Explanation in Developmental Psychology[1]

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The Misunderstanding of Instructions Explanation in Developmental Psychology

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A number of investigators have attempted to account for developmental differences in children's reasoning by citing "misunderstanding of instructions" or "misunderstanding of the task" (e.g., Braine, 1964; Lumsden & Kling, 1969; Nelson, Zelniker, & Jeffrey, 1969; Zimiles, 1966). The reason for observed developmental differences, the argument goes, is that due to ambiguities in the instructions or task presentation, younger children cannot determine what is required. The argument is frequently couched in competence-performance terms; tasks are said to underestimate the child's true competence and to reflect only performance difficulties (Braine & Shanks, 1965).

If a construct such as misunderstanding of instructions is to be useful, it must be clearly defined and independently verified. This is necessary to avoid circularity; it is obviously undesirable to say first that children perform imperfectly on various tasks because they do not understand the instructions, and then to say that the way we know they do not understand the instructions is that they fail on the tasks. In other words, we do not wish to identify understanding of instructions with the entire problem-solving process.

What Does It Mean To Misunderstand Instructions?

An alternative way of conceptualizing the issue is to identify understanding of instructions solely with the initial decoding and representational process (cf. Trabasso, Riley, & Wilson, 1975). That is, when presented with a task, one of the first steps that a child must take is to produce an internal representation of the stimulus display and the instructions. This representation

provides a framework which constrains other aspects of the problem-solving process; those elements of the stimulus display which are encoded, the component operations which are brought to bear on the encoded information, and the manner in which these components are integrated into a solution procedure can be viewed as being dependent upon the representation.

This framework suggests several different ways in which instructions may be misunderstood. They may be roughly ordered in terms of scope or generality; some are identified with specific features of the task or instructions, while others reside in more global features of the experimental situation.

First, a particular term within the instructions may be misunderstood. The most common situation is one in which children are said to misinterpret the term as referring to a salient but misleading perceptual dimension. For example, Lumsden and Poteat (1968) showed that 5- and 6-year-olds identified the term "bigger" with the height of the objects considered. They proposed that some size conservation tasks "permit a confounding of the adequacy of the child's concept of the word with the operations which the conservation task is intended to disclose" (Lumsden & Kling, 1969, p. 83). Similar arguments have been advanced by Griffith, Shantz, and Siegel (1967) with regard to the terms "more," "less," and "same" in conservation tasks, and by Nelson, Zelniker, and Jeffrey (1969) for the term "fuller" in the context of a proportionality task.

Misinterpretation of the task may also result from the instructions being difficult to interpret within the context of the task. The argument here is that the ambiguities bias the child to attend to the wrong elements of the stimulus display. Alternatively, the child may be led to apply inappropriate operations to the encoded elements. Wohlwill (1968), Ahr and Youniss (1970, and Hayes (1972), considering the class inclusion task, suggested that the

child's problem is in determining the correct referent for E's question, given the perceptual display: "It is not so much that the child cannot understand the discrete parts of E's question as that he is compelled to react to the most obvious referent he sees before him" (Ahr & Youniss, 1970, p.). With respect to conservation, Zimiles (1966) argued that the child has a multi-dimensional conception of number, and that the conservation paradigm biases him toward one or the other, depending on the dimension transformed by the experimenter. In addition, Braine (1964) has criticized some transitivity tasks for failing to distinguish between real and apparent length.

The negative effect of ambiguous instructions or miscomprehension of a term may be greater the more mature the problem solver. That is, for relatively mature problem solvers, integrated solution procedures may be associated with the correct representation of the task; in this case success on the task would be largely determined by whether or not the appropriate representation was achieved. However, when the problem solver is less skilled, the effects of misunderstanding may be less apparent—even a correct representation of a problem may not lead to the correct answer. The findings of Lumsden and Kling are consistent with this notion; training designed to enhance mastery of the term "bigger" facilitated subsequent conservation responses only for the older children studied (CA 6-1/2 - 7-1/2), while younger children did not conserve even if their comprehension of the term improved.

A third possible meaning of the misunderstanding of instructions explanation is that the instructions can exceed the verbal competence of the child; here they are viewed as just being too long and syntactically complex for ready understanding. Although a logical possibility, this type of misunderstanding is rarely encountered in the literature, perhaps because researchers tend to be particularly sensitive to the problem.

A fourth problem has to do with the ecological validity of the tasks that are used; young children may never have encountered anything like what psychologists present them, and may have difficulty representing the situation even if the words used are simple, clear, and not misleading. Here the problem lies in global features of the experimental situation, and appears correspondingly difficult to formulate precisely.

Finally, instructions may be misunderstood if the processes necessary to solve the problem are also required to decode the instructions. Braine (1959), articulating this position with respect to transitivity, suggested that the "use of the words 'long' and 'length' to refer to lines which are not straight presupposes comprehension of the additive operations involved in measurement... Comprehension of Piaget's questions would therefore of itself indicate understanding of the additive character of lengths" (1959, p. 6). Here again, the difficulty is identified with general features of the instructions and stimuli.

In using a construct such as misunderstanding of instructions, more than conceptual distinctions are needed; one would like to have means of independently assessing or verifying the various senses of the term. The examples from the literature cited above provide one source of techniques for testing the construct.

The preferred approach for difficulties with a specific term is direct assessment of the child's grasp of the term. One means of doing this is to use a discrimination or identification task in which the perceptual cues the child may identify with the concept are varied orthogonally with the correct dimension. In this way the nature of the child's interpretation can be clarified. Thus, Lumsden and Kling (1969) asked the child to pick out the "bigger" of two wooden blocks, where the dimensions of height, width, and quantity were independently varied.

There appear to be at least two procedures for verifying ambiguities in task presentation. One is clarification of the instructions (Ahr & Youniss, 1970); in this case the relevant or important aspects of the display may be specifically pointed out, the logic being to direct the child's attention to the intended referents of the instructions. The second technique involves giving informational feedback to the child; Braine and Shanks (1965) and Zimiles (1966) have suggested that feedback operates to clarify the experimenter's intentions.

The third and fourth senses of the construct appear to be harder to test in a straightforward fashion; this may be due to the fact that they are not identified with any specific feature of the instructions or the task. In cases where the instructions exceed the child's verbal competence, the use of nonverbal procedures may circumvent the difficulty (Griffith, Shantz, & Siegel, 1967). Similarly, for cases in which the task is simply unfamiliar and unusual, feedback may help to clarify the nature of the task requirements (cf. Braine & Shanks, 1965).

An Empirical Example

The experiments reported here address the misunderstanding of instructions explanation with regard to Bruner and Kenney's (1966) fullness of a water jar problem. In this task, children are shown pairs of glasses and asked to judge which is fuller. Bruner and Kenney reported a three-stage developmental progression on the problem. Five-year-olds based their judgments of fullness solely on the relative heights of the liquid columns, 8-year-olds on the relative volumes of the liquids, and 11-year-olds on the ratios of filled to empty space. Nelson, Zelniker, and Jeffrey (1969) suggested that these observations were misleading; their argument was that young children actually understood proportionality, but were confused by the term "fullness." They suggested that the instructions

"may not place sufficient emphasis on proportionality and therefore encourage the younger child to make a judgment on the basis of more salient perceptual cues such as volume or height" (p. 257). To test this interpretation, Nelson et al. trained 5- and 7-year-olds in a variety of ways, including labelling of stimuli, feedback, and rule instruction. Upon finding that these training procedures were successful, they concluded that "here, as in so many problems in cognitive development, verbal deficiencies or ambiguities in task presentation mask the actual capacity of the child to perform in the required manner" (p. 261).

This explanation seemed to us to run the danger of identifying misunderstanding of instructions with any failure on the task. Given the multifaceted nature of the training procedure, it was unclear whether miscomprehension of a particular term, ambiguities in the instructions, unfamiliarity with the task or some other difficulty was responsible for the failure of the younger children to apply the proportionality rule. Therefore, a more detailed test of the misunderstanding hypothesis was attempted.

First, the rule assessment methodology described by Siegler (1976) and Klahr and Siegler (1977) was applied to the fullness task; it was found that 6- and 10-year-old children's spontaneous rules were in close accord with those described by Bruner and Kenney. Six-year-olds almost always identified the glass with the taller liquid column as the fuller one, while 10-year-olds almost always chose the glass with the greater volume of water. Then we turned to examining the misunderstanding of instructions explanation advanced by Nelson et al.

First, children's understanding of the term "fullness" was directly assessed by means of an eight-item identification task. On each problem, three glasses were presented: one full, one half full, and one empty. After being shown the three glasses, children were told that they needed to identify the glass that was full, the glass that was half full, and the glass that was empty.

It was found that children did not identify fullness with either the height or volume of water in the glasses; rather, they appeared to understand the term perfectly.

Next, children were provided feedback so as to test the ambiguous instructions and unfamiliar task interpretations. Fifteen feedback trials on the task were presented to children of both ages, followed by the 24-item posttest used in the previous experiments. Fewer than 20% of the children at either age induced the proportionality rule; in fact, feedback appeared to increase the uncertainty of children's responding on the posttest, making them appear less rule-governed in comparison to their untutored performance.

In the next experiment, we further assessed the notion that ambiguous instructions were inducing children to attend to inappropriate features of the stimuli. As previously, younger and older children were exposed to the 15-trial feedback procedure and the 24-item posttest; however, in this case the instructions stated that "there are two very important things you should look at. You should look at both the amount of water in each glass and the amount of empty space in each glass." Thus, the children were explicitly directed as to which elements of the stimulus were important to encode. None of the 20 children exposed to this procedure induced the proportionality rule, although some children generated an intermediate rule based on the relative amounts of empty space in the two glasses. Taken together, then, the above experiments yielded little support for a clearly defined misunderstanding hypothesis.

A final experiment suggested that inability to integrate component operations was the source of difficulty on the task. Direct assessment procedures indicated that children were able to carry out the necessary components of

(1) assigning appropriate fractional labels to glasses, and (2) correctly comparing already encoded fractions. When told how to order these two steps correctly, without any mention of _how_ to perform either of them, 90% of the children at each age induced the proportionality rule.

To summarize, these experiments illustrate the need for care in defining and testing the misunderstanding of instructions hypothesis to explain developmental changes. Attempting to clarify the meaning of the construct will hopefully allow more precise characterization of its role in cognitive developmental tasks.

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